Sports nutrionals have gained wide acceptance as an essential component of any committed athletic lifestyle. Additionally, increasing numbers of consumers who aren’t necessarily health club devotees are also turning to sports nutrition products, often in lieu of traditional beverages and snacks. This represents a significant opportunity for food and drink marketers to take advantage of a fast-growing category trend.

The ingredients of those sports nutrionals, however, have to be chosen with efficacy, quality and safety in mind. There is evidence for a beneficial effect of Carnipure™ supplementation in sports nutrition regarding optimization of performance, delaying the onset of fatigue and improving recovery from strenuous exercise both in bodybuilders, athletes and in untrained people. Carnipure™ can thus be considered to be a winning ingredient, helping functional food and supplement manufacturers to capitalize on a healthy, growing market.

What is Carnipure™?
Carnipure™ is a special grade of L-Carnitine, manufactured by the Swiss life sciences company Lonza. Thanks to a unique production process based on fermentation, Lonza is the only L-Carnitine manufacturer capable of producing L-Carnitine in the same way as nature. Products carrying the Carnipure™ quality seal on the packaging show the consumer that they contain pure Lonza L-Carnitine.

What is L-Carnitine?
L-Carnitine, the biologically effective isomer of carnitine, is found ubiquitously in mammalian tissues and plays a key role in the transfer of long-chain fatty acids across the inner mitochondrial membrane. Once inside the mitochondria, L-Carnitine releases these fatty acids and they are broken down through a process called beta-oxidation for the production of ATP or energy. L-Carnitine is also important for the removal of potentially toxic acetyl-CoAs from the mitochondria by forming acyl-L-Carnitines and serves as a temporal acetyl group buffer in the oxidation of carbohydrates during periods of augmented pathway flux. Not surprisingly, given its key role within carbohydrate and particularly fat metabolism, the functional role of L-Carnitine has been the subject of great scientific interest to date.

L-Carnitine metabolism during exercise
According to a recent report on the Sport nutrition market, people are buying more sports nutrition products than ever before, either in form of drinks and bars or as dietary supplements. Not only for athletes sports nutrionals are a substitute from other snacks, drinks and energy providing products. This also has consequences on an indicator of the supply of functionally active L-Carnitine.

High performance athletes such as triathletes have been shown to have lower than normal plasma levels of L-Carnitine even when following an omnivorous diet, as they have a higher excretion of esterified L-Carnitine via the kidneys and via perspiration. This loss may be followed by an increase in L-Carnitine in the body due to presence of a predominantly vegetarian diet. Supplementation with L-Carnitine for 6 weeks increased free L-Carnitine from 10 μmol/L to 85 μmol/L. This considerable increase also improved the ratio of free L-Carnitine to acetylated L-Carnitine, which is an indicator of the supply of functionally active L-Carnitine.

Optimizing performance with Carnipure™
Although it has been known for many years that long-chain fatty acids are important sources of energy in the contracting muscle especially in endurance exercise, the mechanisms controlling fatty acid uptake and oxidation during the exercise are still not completely elucidated. Studies in athletes have shown that Carnipure™ supplementation aids in exercise performance. VO2 max is the maximum amount of oxygen that an individual can utilize during exercise in a set period of time and often used as a predictor of potential in endurance sports. The positive effect of L-Carnitine supplementation on VO2 max has been subject of many research studies involving athletes of various disciplines, such as top rowers, marathon runners, competitive long distance walkers and trained cyclists.

Both an increase in maximal oxygen consumption and a lowering of the respiratory quotient indicate that L-Carnitine has the potential to stimulate lipid metabolism. Carnipure™ supplementation has been shown to stimulate metabolic rate during exercise. In healthy adults, Carnipure™ supplementation was found to increase plasma levels of L-Carnitine even when following a predominantly vegetarian diet had the lowest plasma levels of L-Carnitine. Supplementation with L-Carnitine for 6 weeks increased free L-Carnitine from 10 μmol/L to 85 μmol/L. This considerable increase also improved the ratio of free L-Carnitine to acetylated L-Carnitine, which is an indicator of the supply of functionally active L-Carnitine.

Delaying the onset of fatigue with Carnipure™
Fatigue during exercise is undesirable as it ultimately compromises performance. It can have a central origin, by reducing cognitive performance or lowering excitation of motoneurons. Various mediators are in question (serotonin, modulate, dopamine). On the metabolic level, the most-often evoked changes are reduced pH and increased intracellular lactate level. However, that “lactic acid hypothesis” has been seriously challenged in recent years. During endurance activities, the limiting factors are glycogen reserves and levels of oxidative enzymes.

Intense activities that demand a high output of energy in a short time frame, such as sprinting, quickly deplete glycogen stores. If the use of fat as an energy source can be increased during exercise, this may spare muscle glycogen, thereby delaying the onset of fatigue. Again, there is...
research to indicate that L-Carnitine may be beneficial in this respect. In endurance trained athletes, L-Carnitine supplementation (2 g/day for 28 days) led to a significant reduction in Respiratory Quotient (RQ) during a 45 minute cycling exercise, as compared to placebo. This decrease in RQ indicates a glycogen sparing effect and ultimately, should be associated with improved performance. A consequence of high-intensity training is hypoxia, which increases the concentration of ammonia in blood. Also superimposed heat stress is postulated to augment systemic ammonia response. Ammonia accumulation has been associated with fatigue. Carnipure™ tartrate supplementation in male cyclists has been found to decrease ammonia levels in a well-controlled study. As there has not been any change in amino acid metabolism, this effect may be explained by reduced AMP deamination.

**Improving recovery processes with Carnipure™**

Exercise places oxidative stress on the body derived from two different stimuli. First, the mechanical forces associated with exercise cause cellular structural damage, and subsequently, chemical responses related to damage muscle damage and the muscle repair process cause tissue alterations that can be observed for up to ten days post-exercise. This sensation of discomfort or pain in the skeletal muscles frequently occurs following unaccustomed muscle exertion and is commonly referred to as DOMS (Delayed Onset Muscle Soreness).

The findings by researchers at the University of Connecticut, USA, however, have opened new avenues with regard to a role for Carnipure™ apart from its classical muscle energetic function: Using Carnipure™ supplementation prior to high-intensity exercise can attenuate the biochemical and structural stress responses to high-intensity squat exercise and is significantly effective in assisting recovery. More specifically, Carnipure™ supplementation allows for decreased production of free radicals, less tissue damage, reduced muscle soreness and better utilization of fat as an energy source during recovery.

Potentially, Carnipure™ may improve blood flow during and following exercise, and optimize the signals supporting tissue repair processes. A speedy and less painful recovery is important for all people who exercise, whether professionally or recreationally, as recovery affects how quickly a person can return to exercising optimally. These results are in line with previous findings, and have important practical applications for athletes, as performance after damaging exercise bouts is primarily affected by strength loss and pain.

Most interestingly, latest research shows that this amelioration of post-exercise metabolism increases in response to the daily dosage of Carnipure™ tartrate, however, that it is already statistically significant at a dosage of 1 g L-Carnitine/day.

**And so to conclude**

The physiological function of L-Carnitine in facilitating the production of energy from fat is crucial during exercise, especially endurance exercise, because fat is one of the main fuels used to provide energy for physical activity. An increasing body of scientific evidence illustrates the favourable effects of Carnipure™ for athletes and recreationally physically active people, with regard to optimising performance, delaying the onset of fatigue and improving the recovery process. The growing interest in Carnipure™ can be attributed to a number of factors including its basic function in helping convert fat into energy, its efficacy, its excellent safety profile and, of course, its suitability for processing.

**References**